SOUTHERN ILLINOIS business bulletin

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SELLING IN THE 60's: SALES MANAGEMENT CONFERENCE SPEAKERS

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"SELLING IN THE 60's" IS CONFERENCE THEME

More than 200 businessmen and SIU students and faculty members attended the sessions of a sales conference, "Selling in the 60's," conducted on the Southern Illinois University campus May 10, 1960.

The one-day event, which was designed to present some of the latest information on selling, was sponsored by the SIU Department of Marketing and the Small Business Institute.

Speakers for the event were Robert B. Davis, regional manager of *Life;* Bruce S. Stake, fire insurance manager, Michigan Mutual Liability Co.; Jack Van Pelt, district manager, Dictaphone Corp.; and Robert W. Kelly, vice-president of Kelly, Zahrndt and Kelly, Inc.

The conference opened with Davis' talk on "The American Consumer in the 60's." Stake, a 36-year insurance sales veteran, discussed, "Selling the Intangible," and Van Pelt, who is also vice-president of the St. Louis Executive Association, explained "Selling the Tangible." Kelly, former copywriter, radio and TV director, and account executive, described "selling devices."

The banquet speaker was Ben Smith, general merchandising manager, Southwestern Bell Telephone Co. Mr. Smith proved that he had definitely earned his title as one of the nation's most outstanding salesmen. In his excellent talk he outlined tested and proved techniques for getting "yes" answers in selling situations.

ON THE COVER

This issue's cover picture is a montage of speakers in action at the SIU Sales Management Conference (see story above). The speakers are (1) Ben Smith, (2) Robert W. Kelly, (3) Bruce Stake, and (4) Jack Van Pelt.

SIU people on the program were R. Ralph Bedwell, director of the Small Business Institute, who spoke during the afternoon on "The Southern Illinois Consumer," and Dr. Paul M. Hoffman, chairman of the Marketing Department, who served as master of ceremonies. Charles E. Rosenbarger, instructor in marketing, was in charge of arrangements.

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LAND IS A GREAT RESOURCE OF SOUTHERN ILLINOIS AREA

by L. R. Tucker

L. R. Tucker is a horticulturist in the department of plant industries in the SIU School of Agriculture. He received his Ph.D. from the University of Massachusetts and joined the SIU staff in 1947.

Aside from the people of southern Illinois, the land is the greatest continuing potential resource of the area. Present land returns are much lower than their potential. Knowledge is available to enable people to change this potential into continuing actuality. However, an enormous amount of educational stress has been along other lines. With the present land income low, the taxation base is down followed by small income for local schools, therefore lower than average educational opportunities are available for the young. This is followed by immediate opportunities for the more capable, better trained, low financed youngsters to go to other areas, particularly upstate, at higher salaries than prevail in southern Illinois.

Few returns are as valuable to southern Illinois as the improved continuous actual income from our land base in this mild, humid climate although many others are more glamorous and seem more immediately important. The bible reference "for he that hath, to him shall be given: And he that hath not, from him shall be taken even that which he hath" applies here in southern Illinois. Every landowner, teacher, and citizen in southern Illinois faces the responsibility and opportunity of aiding in the transfer of potential land income to immediate and continuing high returns.

Along the roadside in a southeastern state was a slogan showing a narrower but inspired theme. It was "pasture at its best improves all the rest." The Soil Conservation Service tells us what to do but does not emphasize what the increased return will be. This slogan is "put the land to its best use and treat it according to its needs."

Enthusiastic, up-to-date land treatment and use is one of the most important policies that southern Illinois must follow if it is to raise its own standards and opportunities and reduce its losses (as an example, the migration of trained, capable people). This local income improvement is as important to the public as to the private citizen because all income ultimately rests on a natural resources base. Plant production is one of the few continuing land resource income bases. It is available as long as the sun shines, the rain falls, and humanity treats the land wisely. Land at its best improves all the rest.

EACHING MACHINES: NEW CLASSROOM AIDS

by Leonard J. West

will be a strong testimonial to the weight of tradition er hard empirical fact if "teaching machines" do not ceive extensive investigation as possible aids to learning the classroom.

—William K. Estes
Article on "Learning" in Encyclopedia of Educ. Research

As time goes on, more and more people want ore and more education. Some propose to meet ie demand by building more schools and training ore teachers. These are probably not sufficient lutions. We must also seek greater efficiency in onducting instruction. This article describes a ody of ideas about, and techniques for, the conuct of instruction aimed at greater efficiency in arning. As indicated in the title, these techniques volve the use of automated devices or so-called eaching machines."

We all teach or expect to teach, and we all have inions about teaching and learning. No doubt e very idea of devices for teaching strikes terror to the hearts of some and often generates emoonal reactions. Let us, instead, try to be rational. et us examine what we mean by learning, and entify the conditions under which learning takes ace most efficiently.

Education and Psychology

Education deals with learned behavior. Intelli-nt teaching involves the introduction into the arning situation of conditions which will maxiize learning. The problem becomes one of identiing those conditions. Can we do so? Or is human ehavior so complicated, so fraught with a large umber of subtle and interacting variables, that it all—as William James once described infancy—ie "buzzing, blooming confusion"? Must successl teaching be entirely or nearly wholly an art? r can it be made to some extent a science? Can we entify conditions that will lead to specified reults with a high degree of probability quite inependent of individual differences in human teachg skill?

Just as the physicists, the chemists, and the tronomers have shown us the essential lawfulness nature; similarly, we should expect that human ehavior is not chaotic, not one "buzzing, bloomg confusion," but also lawful and orderly. Psyology, as a discipline, is formally defined as the ience of behavior. It is the business of a psychol-y of learning to determine the regularities in learned behavior—to determine, in a phrase, the conditions that will maximize learning.

Education, on the other hand, has been a place for the application of scientific findings about behavior and not, under most circumstances, a place for making basic discoveries about learning processes. Psychology is (or tries to be) a science; whereas education is a technology which uses (or should use) the findings of its parent science. It has not, in fact, done so to any notable extent in recent years but, instead, has taken refuge in windy philosophies. As stated by B. F. Skinner:

> Denied the opportunity to control via the birch rod, quite at sea as to the mode of operation of the few techniques at her disposal, [the teacher] spends as little time as possible on drill subjects and eagerly subscribes to philosophies of education which emphasize material of greater inherent interest. A confession of weakness is her extraordinary concern lest the child be taught something unnecessary. The repertoire to be imparted is carefully reduced to an essential minimum . . . Eventually, weakness of technique emerges in the disguise of a reformulation of the aims of education. Skills are minimized in favor of vague achievements —education for democracy, educating the whole child, educating for life, and so on. And there the matter ends; for, unfortunately, these philosophies do not in turn suggest improvements in techniques. They offer little or no help in the design of better classroom practices (3, p. 92).

With such philosophies, couched in terms utterly beyond any sort of operational definition, it is small wonder that educational practices are sometimes a species of Alice in Wonderland. There has clearly been something of an iron curtain between psychological findings and educational practices. Why?

One source of the breakdown of communication between the two disciplines is the increasingly specialized jargon employed by psychologists. Just as "educationese" is a foreign language to psychologists, "psychologese" is a foreign language to teachers.

Second, experimental inquiries into learning processes have mainly used infrahuman organisms like the white rat. The rat in a maze or on a jumping stand would appear to have precious little to do with the human being in the classroom. At the same time it has been shown beyond all cavil that for certain classes of learning tasks, the conditions which help the rat to learn are also the conditions applicable to much of human learning. This is *not* to say that humans are rats or that there are not important ways in which humans differ from rats. If you are still reluctant to extrapolate to human affairs from data on lower organisms, may I remind you—as just one of many possible examples —that virtually everything we know about the mechanisms of human genetics stems from work with a vegetable and with an insect, namely, from

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Gregory Mendel's work with sweet peas and Thomas Hunt Morgan's work with fruit flies.

Finally, and this is perhaps the main source of the iron curtain between education and psychology, psychologists have not felt until recently that they could exercise sufficient control over the relevant variables to venture advice and recommendations to education on any substantial scale. Experimentalists tend to be a pretty cautious breed, not given to wild or fanciful claims. The plain truth is that the past ten years have been a period of major breakthroughs in learning. The very fact of the present willingness of psychologists to make educational "noises" may be taken as a suggestive, if not definitive, indication that they do indeed have some useful things to say.

Lest there be any possible misunderstanding, I refer to the findings of the experimental psychology of learning and not to any other brand or branch of psychology. The experimentalists are *not* the people who ask you in your daily newspaper to "Rate Yourself," or who, in the pages of the slick magazines, advise you to "Be Glad You're Neurotic," or who discuss the perennially live issue of "to spank or not to spank" for childish misbehavior. In other words, until quite recently the findings of the experimental psychology of learning have been presented exclusively in the professional journals, quite apart from the psychology and pseudo-psychology which the non-specialist—educated or otherwise—is likely to have stumbled on. Or perhaps I should say "stumbled over."

Conditions for Efficient Learning

With all the foregoing as background, I shall next describe five major conditions which, if fulfilled, can confidently be expected to lead to enormously increased efficiency in the conduct of instruction. Some of these notions will seem quite familiar, others, perhaps not. In any event, the thing to ask yourself in connection with each of them is *To what extent is it possible for you and me, for the individual teacher—or for teachers in general—to conform to these requirements for learning under the presently typical conditions of classroom instruction?* I think you will recognize —reluctantly or otherwise—serious inadequacies in the present state of affairs.

Learning is an inference from performance. Performance, by definition, means doing something; behaving, acting, responding. Any given instance of learned behavior (or any behavior for that matter) consists of making certain classes of responses to certain classes of stimuli. The question at issue then becomes: What are the conditions under which we get a person to associate a given response with a given stimulus? How do we get Johnny dependably and regularly to say "eight" when asked for the sum of six and two, and not some other number? How do we get him to spell "occurring" with two r's? to debit both "Freight In" and "Freight Out" rather than to debit the former and credit the latter? to compute a markup on selling price rather than on cost, when appropriate? t recognize the applicability of Gresham's Law unde a given set of conditions? to compute an inde number correctly? and so on.

Well, of course, we have to present the stimul to which the relevant responses are to be attache But even before that—and, indeed, continuall throughout the learning—we are supposed to moti vate the learner. Some pretty weird things hav been done under the name of motivation, rangin from trivial and irrelevant games at grammar an even high school levels to the suggestion that bab will never get to be president of the United State if he does not eat his spinach. A rather more per tinent and more useful notion about motivatio is that its purpose is neither more nor less than t make the learner pay attention to the stimuli whic are to be presented.

The first step in the process, *Condition 1*, ther is to insure that the learner is *paying attention* Whether you do this by sledgehammer or, as on writer on the topic observed, "by use of birch rods electric shock, Chinese water torture or by promise of ice cream, movies, or money is irrelevant" (1 p. 461). There is no point in bombarding th learner with stimuli if he is not set to perceive them Now the question is: How much of the time, as w stand before our classes, can we guarantee tha everyone is looking and listening? The first respect then, in which typical classroom practice can ofte be weak is in the matter of securing attention *t* and, thereby, perception *of* stimuli.

My second point has to do with presentation c stimuli, with presentation of the material to b learned. For the most part we talk at the studen The student is a passive receiver of instructio rather than a maker of responses. Note that the so called "lecture method," which everybody damn but uses anyway, is not a method of instruction bu simply a method of presenting stimuli. The gadge ry that goes to make up what we call audio-visua aids (movies, film strips, TV, et al.) is of the sam class—it does nothing but present stimuli. Ditt for textbooks, in which there may be end-of-chapte questions which the instructor may or may not hav his students answer, but for the most part the stu dent is a passive reader of words in print.

In short, much of instruction is a one-way proce with little if any immediate and continual inter change between teacher and learner. Much c classroom instruction allows the learner to be pa sive, let alone inattentive; whereas one of the pr mary conditions for learning is activity on the pa of the learner. By activity is meant the making c relevant responses to relevant stimuli or cues. *Con dition 2*, then, is that the learner be actively an continually engaged in making responses.

My third point has to do with *two* characteristic internal to the materials to be learned—whethe presented by textbook, lecture, or what have yo *First*, the important cues are not generally specifie and pointed up. Instead, they are often buried i

ıe surrounding verbiage, and students often have rouble discovering or identifying just what the ıain points or important concepts are. The teacher nd writer would do well to adopt the naval prac-ce of a loud and clear "Now hear this" as a reface to each point of importance.

A *second* characteristic of instructional materials nd their typical modes of presentation is that they ecessarily assume that all students are alike: first, ith respect to the background of information they ring to the new learning task; and second, with espect to their ability to move toward mastery of ieir task through the series of steps that happen) be built into the materials of instruction. The cturer or the textbook writer may move from oint *a* to what he believes to be point *b* (but which really, to some students, point *c*); or he may ıtentionally move from point *a* to point *c* on the land assumption that the bridge between the two oints is self-evident and need not be specified. His ssumption will be correct for some students, but rong for others. And so it goes—with dozens of ıch instances in practically every chapter and in ractically every lecture or talk—including this ne! The teacher or textbook writer or speaker who an regularly and routinely lead practically all his udience unerringly through his materials—so that l follow and all learn—is a stupendous rarity. To ısist that all teachers *should* be able to do so is s idle as to insist that all persons should be gen-ıses. Individual differences among learners is a ıct of life. The psychologist mentioned earlier ho is as hospitable to electric shock as to ice cream s a means of securing attention has observed, in ɔnnection with individual differences, that "The eacher who proceeds to treat everyone alike may e displaying a fine democratic spirit but he may e violating other laws than those guaranteed by ıe Constitution" (1, p. 459).

The great trick is to take the fact of individual ifferences into account through correct "program-ing" of the materials to be learned. *Condition 3*, ıen, is a sequential presentation of what is to be arned that leaves no important gaps.

This leads me to my fourth major point, which another aspect of individual differences, concern-g the *rate* of instruction. Usually we have in ind, either explicitly or implicitly, some set of ɔjectives for a course, and we have a fixed num-er of weeks or months to accomplish these objec-ves. And so we lay out the topics to be treated, ecide how much time to spend on each, and then arch along this predetermined route. The extent which we can or are willing to modify this plan ordinarily limited. Even with *ad hoc* modifica-ɔns as the occasion may demand, we can never ıess right. We are always going too slowly for me, too fast for others, and are quite fortunate we are going at approximately the right speed r as many as half the class. The ideal, of course, for each person to learn at his own best rate. *ɔndition 4*, then, is a rate of presentation that is exactly right for each individual learner.

The fifth and last major requirement for learning is perhaps the most important of all and definitely the one most commonly violated. It has already been mentioned that in connection with each "stimulus" tossed out by the teacher or the textbook the learner must be active—the activity consisting of making a response to that stimulus. When the response is made—and now we come to the crux of the whole matter—the learner must be informed in one manner or another as to whether or not his response is correct. Some one or some thing must give him knowledge of results. Knowledge that a response is correct—through an affirmative nod from teacher, a "that's right," a "good," or some indication of approval or acceptance—is said to reinforce that response and to increase the probability of its re-occurrence. If the response should re-occur inappropriately, to the wrong stimulus, we withhold reinforcement. By this means the learner comes to make the proper responses to the proper stimuli. Not only must reinforcement be furnished for correct responses, but the reinforcement must be closely contiguous to, must occur close in time to, the response if it is to have any effect in shaping behavior. As Skinner has insisted:

> . . . the lapse of only a few seconds between response and reinforcement destroys most of the effect. In a typical classrom, nevertheless, long periods of time customarily elapse. The teacher may walk up and down the aisle, for example, while the class is working on a sheet of problems, pausing here and there to say right or wrong. Many seconds or minutes intervene between the child's response and the teacher's reinforcement. In many cases—for example, when papers are taken home to be corrected—as much as 24 hours may intervene (3, p. 91).

On the analogy of the servo and control mechanisms developed by the engineers, all this is called a "feedback" process. Information about the correctness of his behavior is "fed back" to the learner. I think we would all agree that immediate feedback to each and every learner is quite absent under ordinary classroom conditions. Even if most teachers were aware of the crucial necessity of immediate reinforcement—which is doubtful—they would still be unable to furnish it. It is a physical impossibility for the human teacher, unless he calls for a unison response from his class, to reinforce more than one person at one time. Besides, the variety of notions and responses that may be in the minds of thirty different students hardly needs mention. *Condition 5*, then, is immediate feedback for responses.

Here, now, are five of the major requirements for efficient learning: (1) attention to stimuli by the learner, (2) active and overt responding to stimuli by the learner, (3) immediate reinforcement of correct responses. In addition, we want (4) an ordering of events, a programming of the

instruction, such that each item leads inevitably into the next, moving the learner toward mastery, AND (5) at a rate appropriate to each learner individually.

These conditions may sound Utopian. They are, in fact, quite unattainable under ordinary classroom conditions. If you protest that the only way to meet these five conditions would be to have a teacher for each student—and, more than that, an infinitely skillful and patient teacher who knows just what material to feed out and at what rate—you will be exactly right. Education does, indeed, consist of a Mark Hopkins at one end of a log and *a* student at the other—except that today we can replace the log with something better. Mark Hopkins is still present in the form of the man who writes the instructional program, but we put that program into a device which feeds it out to the learner, which forces him to pay attention by calling for responses, which immediately informs him of the correctness of his responses, and which moves him along to subsequent items in the program in accordance with his mastery of earlier items. With a device of this sort *for each student*, we have taken a giant step toward fulfilling the major conditions for learning I have described.

If you can imagine a dialogue between the live teacher and a teaching machine, on the matters of getting attention and eliciting and reinforcing responses promptly, the machine could borrow a line from the song in "Annie Get Your Gun," namely, "Anything you can do, I can do better." That is the heart of the matter; there are certain things that the machine *can* do better.

If there are certain conditions that must be fulfilled if there is to be efficient learning, then it is right and proper that we seek ways that will most nearly meet these conditions. That is why I tried to set the stage by showing that the familiar instructional procedures do an indifferent job of meeting the crucial conditions for efficient learning. "In any other field," as Skinner has pointed out, "a demand for increased production would have led at once to the invention of labor-saving capital equipment. Education has reached this stage very late, possibly through a misconception of its task" (4, p. 969). Let us, then, relieve the teacher of obligations he cannot conceivably fulfill adequately and free him for the tasks for which he is uniquely fitted.

Teaching Machines

Let us next examine a typical teaching machine and part of a typical program for such a machine. At present there are about one hundred such devices being marketed by about forty different manufacturers. These range from a little box-like affair that a high school carpentry class can knock together for a few dollars to sophisticated electronic devices costing many thousands of dollars. The functions performed by such machines vary, and the manner in which they carry out these functions also vary. But the machine is a private tutor; there's a machine for each student. Second, *the machine uses the Socratic method*: it breaks down the subject matter to be learned into a series of steps—small or large according to the judgment of the persons responsible for the program—but preferably very small in the present view of most specialists—and it presents these steps in the form of direct questions to the student, who either composes an answer or selects one from a series of options presented. It moves the learner along through the Socratic method of question and answer. With this as a quick overview, here are the eight functions, as described by Dr. Lawrence M. Stolurow of the University of Illinois, which such machines can perform (5):

1. It presents information either as questions or as statements and then questions. This is the *presentation* function.

2. It requires from the learner a response that is overt and measurable. This is the *response* function.

3. It compares, or permits the learner to compare, his response with a predetermined correct response. This is the *comparator* function.

4. In any one of several different ways it informs the learner as to the correctness of his response. This is the *feedback* function.

5. It arranges or orders the material to be presented. This is the *programming* function. (At the outset, of course, it is the human being who makes the program, and the machine is just a "house" for that program.)

6. It allows for variability in the rate of presentation of information. This is the *pacing* function.

7. It makes a record of responses and thus combines learning with its measurement into a single set of co-ordinated operations. This is the *collator* function.

8. It automatically rejects the correctly-responded-to items, so that from trial to trial the learner is presented only with information over which he has not yet demonstrated mastery. This is the *selective* function.

(It may have been functions such as these that Thomas Gilbert had in mind when, in a paper read at the 1959 meeting of the American Psychological Association, he cautioned the Home Economics Department to resist the temptation to refer to the electric toaster as a teaching machine.)

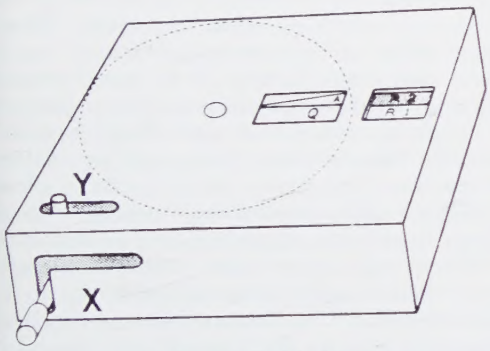
These are the eight functions which machines can potentially perform. Whether you want a device to perform all or only some of these functions and in one way rather than another depends mainly on the task to be learned and on the investment one is willing to make. The physical appearance and mode of operation of these devices vary widely. The one to be described is just one of many and in fact, one of the very simplest types. It is not to be taken as a precise and limiting description of all such devices.

Description of a Device and a Program

Figure 1 displays a sketch of a shallow box of

ze that sits and fits conveniently on a small desk table. Under the locked lid of the box, hidden om view, is a disc on which a series of questions printed, radiating out from the center of the disc turn. A window is cut in the lid, exposing to ew a single question. In figure 1 that is the perture marked Q. In the space marked R1 the arner writes his answer. When he next pulls ver X, this rotates the disc so that the correct nswer, heretofore hidden from view, rolls into the nswer window at A, and at the same time moves is answer from the R1 position to R2—which is nder glass so that he can no longer tamper with is response. In this particular device, the learner cores his own answers. If his response matches the redetermined correct answer, he slides lever Y, hich notches or otherwise marks the disc so that at item will not reappear on the next go-round. n this fashion the learner is presented only with ems over which he has not yet demonstrated mas-ery. He works through the program of instruction, em after item, in the manner described.

Figure 1



Skinner Disk Machine

This device is, of course, a very simple one. If ne wishes one can get a device which automatical-scores responses—so that cheating is not possible. ne can prepare programs and get devices for dis-laying them that take the student back over the me ground if he should make a wrong answer nd which advance him if and only if he is correct. ne can make programs which take bigger leaps om item to item after a predetermined number of orrect answers has been made and which backtrack nd slow down to smaller steps if the student proves nable to handle larger ones. There are programs nd devices which branch off into byways that rove to be of especial difficulty, but which keep n the main road, without branching off, in the in-ance of the student who is not having difficulties. nd so on, for nearly every eventuality and cir-mstance one could conceive of or desire.

Lest all this sound too Orwellian, too 1984-ish, should be perfectly apparent that at present, at ast, the machine is the unthinking servant of the an. Somebody, some human, has to prepare the rogram for the machine and to "instruct" the machine how to behave in the light of the varying responses or series of responses that students can, and assuredly will, make.

Figure 2
PART OF AN INSTRUCTIONAL PROGRAM ON BAILMENTS

1. *Bailment* is from a French word meaning "to keep in custody" or "to deliver." Thus, when *personal property* is placed in the hands of someone other than the owner, we say that a(n) ..... exists.
2. You will recall that personal property is property that can be moved; while real property is land and things attached to the land. A bailment does *not* apply to real property. Only ..... property, which is movable, may be the subject of a bailment.
3. If your family rents the house you live in, no bailment exists because only .... may be the subject of a bailment.
4. Since a typewriter is personal property, if you lent your typewriter to a friend a(n) ..... would exist.
5. If you lend your typewriter, you expect it to be returned to you. In lending it, you have transferred *possession*, but not ownership of, or title to, the typewriter. In bailments, then, it is not ownership or title that is transferred, but .....
6. The owner, legally called the *bailor*, is the person who temporarily gives up possession of his .... in a bailment.
7. In the bailment created by lending your typewriter, you, as the owner of the property, would be the .....

•
•

10. The person to whom ..... of personal property is transferred is legally called the *bailee*.
11. The legal term for the person who receives possession of personal property belonging to someone else is .....

•
•
•

40. Work and services bailments are classed as contract bailments. On the other hand bailments for the sole benefit of one of the parties are known as ..... bailments.

Answers: 1. bailment 2. personal 3. personal property 4. bailment 5. possession 6. personal property 7. bailor 10. possession 11. bailee 40. gratuitous

To get some "feel" for a program appropriate to the very simple disc-and-windows device just described, examine the series of questions, shown in Figure 2, making up part of an instructional program on the topic of "bailments," as this topic is conventionally treated in high school business law courses. The program was prepared and tried out by Mrs. Geneva Ewan, working under the guidance of the present writer. The materials are designed to lead the learner in an effortless, step-by-step fashion to mastery over a number of simple facts and concepts relating to the topic: the defining

characteristics of a bailment in general and of certain types of bailments in particular, the degree of care or skill that must be exercised by the bailee, and so on. Figure 2 shows nine of the early items (plus the last item) from a 40-item program. The program looks like a test—and in a sense it is a test. But, primarily, it is a learning device. We ask the learner questions, but we ask them in such a way that he is virtually guaranteed to get right answers. In the early items, the correct answer is "given away" by the very wording of the question. In later items, these cues are gradually diminished or "faded away," so that the learner has to rely on what he learned from making responses to earlier items in the program—see, for example, Item 40. In this fashion, the learner is gradually brought to genuine mastery of the topic.

Notice how beautifully the five pre-eminent conditions for learning are fulfilled by instructional programs of this kind. Filling in the blanks forces the learner to make active responses. The requirement of responding necessitates that the learner pay attention. With skill in writing items, one attains a sequential treatment of the subject matter, leaving no important gaps. With a display device that shows the learner the right answer immediately after he has made a response, immediate reinforcement for responses is furnished. Finally, since there is a display device or "teaching machine" for each student, each student works through the program at his own rate on an individual basis. Brighter students race through an instructional program, while slower ones are tutored as slowly as necessary.

With real skill in item writing on any chosen topic (as Skinner has observed): "An understanding of the subject emerges which is often quite surprising in view of the fragmentation required in item building."* Proper programming is, of course, the heart of the matter. There is by now a rapidly accumulating body of information and suggestions for writing instructional programs. It is again Thomas Gilbert who warned us against letting the tail wag the dog by pointing out that "If you begin with a device of any kind you will try to develop the teaching program to fit that device." And so his advice is: "If you don't have a gadget called a 'teaching machine,' don't get one. Don't buy one; don't borrow one; don't steal one. If you have such a gadget, get rid of it. Don't give it away, for someone else might use it" (2). And then he goes on to describe in step-by-step fashion how to go about writing a program. Once you have a program, then you go out and beg, borrow, steal, buy, or make a device for displaying that program.

Who Writes Programs?

Does each teacher write his own program? In the words of the old song: "No, no, a thousand times no!" A good program requires absolutely expert mastery, not just ordinary mastery, of the subject matter involved and also, for some areas, skill with words of an exceptional order. It is not unlikely that a good program may require the joint efforts of a subject matter specialist, a psychologist, and a skillful writer. While this combination of talents may occasionally reside in one individual, this is unlikely to be generally the case. A ranking mathematician could probably not be persuaded to write a primer for elementary school arithmetic. But he might be interested in preparing a program for an automated device such as the one described. In fact, specialists by the dozens are busily engaged in doing just that—in writing programs for mathematics and science, to name just two of many instances. It is rather revealing that the earliest cooperative efforts have been in mathematics and in science—in disciplines which by their very nature reject an emotional egocentrism, which seek instead to identify the relevant variables, and which welcome devices and techniques which furnish the necessary control over these variables.

What Can Be Mechanized?

Not all subject matters or all parts of some subject matters are mechanizable—although I suspect that in the coming years many more will be found to be so than would appear at first blush. Here are, in fact, some of the areas for which teaching machine programs already have been prepared: accounting, algebra, arithmetic, binary arithmetic, card punching, educational psychology, electronics, elementary number theory, geography, German, law, machine operations, map reading, physics, psychology, radar operation, reading, Spanish, spelling, statistics, trigonometry, and typing. Is there any reason why many other school subjects (or parts of them) could not be added to the list?

One necessary, but not sufficient, criterion for determining whether the instructional program for a given subject matter is mechanizable for use on a large scale throughout a school or for a number of schools is that there be some consensus as to what the field consists of, as to what the objectives of instruction are. There has to be agreement as to the truth of any given set of statements describing the content of the field. To any set of questions incorporated into an automated instructional program there has to be agreement on what are the right answers. I mention this because of the common claim "My objectives in teaching such and such a course differ from those of Mr. X." We bitterly resent, sometimes rightly, any attempt to straitjacket us into one mold. With all due respect to this point of view, liberty is not license. If any given academic discipline cannot reach considerable consensus on what it itself is all about, then it has no basis for calling itself a discipline and no business under an educational roof—whether in the kindergarten or in the graduate school. On particular issues in the field on which there is legitimate difference of opinion it is a simple enough matter to build instructional items which treat these issues in an appropriate way.

*See Reference 4 for a sample 35-item program on the topic of "incandescence" in a physics course.

Types of Teaching Machines

In connection with the sorts of things susceptible
"automated" instruction, it should be mentioned
hat the "hardware" described earlier is only one
several means of incorporating the important
onditions for learning. In teaching foreign lan-
uages, phonograph records are part of the "hard-
are." For teaching some skills, visual displays
either still or motion picture) are used. For topics
ot readily managed through the writing of a series
items of the brevity of those illustrated in Figure
or in which responses of the multiple choice or
rief fill-in form are inappropriate, the "teaching
achine" is not a piece of hardware but a special
ind of textbook called the "programmed textbook."
ach little paragraph of the text is followed by
uestions which the student is to answer. When
s answer (depending on whether it is correct or
correct) determines whether he reads ahead and
hat he reads next, we have a variant called the
scrambled textbook." Skillful programming aside,
e heart of efficient learning is active responding
nd immediate reinforcement for correct responses.
Whether these conditions are best met by a piece
hardware or by a special kind of book is not
aterial. "Software" (e.g., a book) is a "teaching
achine" too if it incorporates the efficient condi-
ons for learning in such fashion that learning
kes place without the intermediation of a live
structor. The human teacher—even when he is
vare of the important conditions for learning—
nnot hope to meet these conditions as efficiently
do the devices here described. To the comment
y Estes which introduces this article, one can only
y "Amen!"

High-Level Behaviors

Perhaps you feel that these teaching machines
re all right for cut-and-dried matters like 2 plus 2
qual 4. "But that's not what we're after," you may
thinking. We want to teach students "to think,"
o exercise judgment," "to make intelligent deci-
ons." In this connection, Professor Bugelski (the
hinese water torture man) has observed that
Some students even expect to learn how to think
nd some instructors are immodest enough to sug-
st that they can teach students to think" (1,
450). Perhaps he means by his illusion-shatter-
g comment that problem-solving behaviors are
area about which we, as yet, understand very
tle and know less. But I think he also means that
-so long as the objective is stated on so gross a
scriptive level—it is a brand of mysticism little
ss offensive than the educationist aims of life ad-
stment, educating the whole child, and the various
mbinations and permutations of similar gobble-
ygook. The real questions are: to think about
hat? to exercise judgment about what? to make
telligent decisions about what? To make any
rt of headway in these areas it is necessary first
clear away the misconception that thought,
dgment, and intelligent decision-making are gen-
al attributes of the intellect and to recognize in-
stead that they tend to be specific to specific do-
mains. Mr. X may think and behave soundly politically, but not economically. He may be a whiz arithmetically, but an ass geometrically. I do not mean to paint these contrasts too starkly, for if each "kind" of thinking is grossly different from any other kind, education is a hopeless task. All the same, differences do tend to exist, to some extent at least.

A second necessary step in coming to grips with thinking and with problem solving is to define terms. Woodworth and Schlosberg have said that "Thinking . . . occurs when the organism's explorations go beyond the immediately given situation and utilize memories and previously formed concepts." "A problem . . . exists," they say, "when the organism's activity has a goal but no clear or well-learned route to the goal. He has to explore and find a route" (6, p. 814). Both thinking and problem solving often call for observing and attending to detail, for marshaling relevant material, for identifying what is germane and for rejecting the irrelevant, for refusing the easy but wrong solutions. Are not such behaviors, as Skinner has pointed out, quite likely outcomes of an instructional program which instantly "punishes" for inattention and instantly reinforces for correctly sorting out the relevant factors and for reaching an acceptable solution? Developing these more complex behaviors may often require a bit more room to move about in than is afforded by the question-and-brief-answer techniques illustrated in Figure 2; but such other devices as the "programmed" or "scrambled" textbook should help to satisfy this need.

The main point on this whole matter of thinking and problem solving is that it is necessary to break them down into specific instances of the desired behaviors. It will take painstaking and intelligent effort to do so. But there is no other choice if these objectives are not to remain lofty ideals to which we give lip service, but on the attainment of which we have precious little to show.

Implications for Grading

Another important outcome of the use of these devices is a complete change in the meaning of our grading system. These devices may make the burning question of heterogeneous versus homogeneous grouping of students a pseudo-question; and they may bring about a possible redefinition of what we mean by aptitude. Aptitude tests for academic subjects are ordinarily validated against teachers' marks at the end of training. If a low-scoring student does happen to receive a failing grade, we do not know whether he just does not have the capacity to master the work, given an indefinite time, or whether he could not master it in the time allotted to the course. Under machine instruction, in which everyone proceeds at his own optimum rate, given sufficient capacity and assuming a good program, all will master the course—in greater or lesser time, as the case may be. And since each student has his own device as a private tutor, grouping by ability

would be (under some conditions) no longer an issue. Instead, programs at different levels of difficulty might be found to be appropriate.

In any event, a *C* for the course might mean that it took the student four months rather than two months to get through the course or, preferably, that a student has gone halfway through the course in a given time and that with more time he can earn an *A*. The quick student, in the meantime, will have romped along picking up *A's* in other subjects. Grades no longer are motivating devices; instead, *time* is. With the possible exception of a few who may wish to drag out their years of schooling as long as possible, it is hard to imagine more powerful motivation for attending to business than a payoff in time. Thus, at collegiate levels, the brilliant student could complete his baccalaureate training in perhaps little over a year. This is, of course, exactly as it should be; any enforced drag-out would be shameful. One hesitates to estimate how far in the other direction some students might go or might be allowed to go under whatever limits administrative officers might set.

In any event, under an instructional scheme where success in learning is virtually assured, who knows?—large numbers of students might even come to like going to school.

Refining the Programs

Still another special feature of the instructional devices and programs described is that they are self-correcting. The programming team at first puts together a course of instruction according to their best judgment in the matter. When inserted into an appropriate device, not only is the learner furnished with feedback for his responses, but the records of the learners' responses furnish the programmers with precise feedback as to the quality of the instructional program. Steps which are too far apart are readily identified, and intervening items can be composed and inserted into the program. Similarly with other kinds of deficiencies. In relatively short order it becomes possible to identify and to correct deficiencies and thereby to arrive progressively at improved programming sequences. Contrast this with the state of affairs under typical classroom conditions, in which it is very difficult to determine with sufficient precision what the difficulties are. We have general impressions, but we can rarely cite chapter and verse, so to speak.

Research On Learning

To us who teach, the programs and devices described relate to our desire to achieve educational objectives. Although psychologists also view these new developments as a potentially major contribution to education, they are even more interested in these devices as research tools—as a means of finding out more and more about the learning process. With the high order of control over the relevant variables afforded, in the main, by the accurate record of responses made to specifiable stimuli, they are now in a position to accumulate data on a mass scale. Not data on rats, not data on one human being at a time learning a list of nonsense syllables under the controlled conditions heretofore afforded only in the laboratory, but, instead, masses of data on masses of humans learning hundreds of real-life tasks. And all this can now take place in the ordinary classroom.

Conclusion

Someone once remarked that when something is really known about human behavior, atomic physics will seem like a child's game. Well, experimental psychology, in the brief span of less than a century, has brought us to the threshold of coming to grips with that most fascinating of phenomena—human learning of human tasks.

In closing, let me point out once again that the heart of the learning process is to elicit responses and to reinforce them promptly, and that this must be done for each and every learner. It was just as desirable 2500 years ago as it is today for the teacher to have analyzed his subject matter. The new devices simply point up the acuteness of this need. If each of us were to attempt to write a little piece of a little program for something we teach—in the manner, say, of that shown in Figure 2—I suspect many of us would be astonished at the gaps in our own information and at how difficult it is to write straightforward English. And if we were to try out our first attempt at a program on a number of students, it would open our eyes to how commonly—usually, too, without awareness—we incorrectly estimate the steps on the road to mastery.

I have very carefully used the word "threshold"—not only because human behavior is, indeed, a subtle and complex phenomenon—but also because automated instruction is so new that definite findings are not yet available. At the present moment in time early attempts at programming are completing their first trials and are undergoing revision. Within the next few weeks, months, and years an avalanche of reports will be forthcoming. It is the considered judgment of many competent specialists that the probable results will justify the current enthusiasm.

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'HAT MANUFACTURERS ASK ABOUT SOUTHERN ILLINOIS

by James F. Cannon

My subject is Manufacturers' Questions about inois. Although the questions vary from industry industry, they are somewhat similar. These quesns can be summarized into nine basic ones.

Before I list these questions as such, I would like talk with you about the basic cost factors that industry must bear in mind as it gives considerion to a new plant location. The four principal sts are (1) the cost of acquiring and transporting w materials to the plant site; (2) the cost of inging together manpower, utilities, capital, and ocessing the raw materials into a finished proıct; (3) the cost of selling the product; and (4) e cost of transporting the product from plant cation itself to the market place. Bearing these sts in mind, it becomes somewhat easy for us to terpret and appreciate the questions that have en asked of the State Division of Industrial Plang and Development about Illinois communities. ne questions are:

Where can I locate my plant that will give me e greatest advantage from the standpoint of acıiring raw materials and distributing my products the market place? For many years we in southn Illinois were not concerned with the cost of inming raw material. Our greatest single industry Coal Mines) did not use incoming raw material. ne finished product was already here. To secure her types of industries, we must now concern rselves with these things—the cost of incoming w materials as well as the cost of distributing our oduct to a market place. The fact that we are om 200 to 350 miles from the city of Chicago d the market place which it represents and the ct that we must bring raw materials from Chigo and other regions, makes the question of a mmunity's location of utmost importance. The eatest advantages of this area are its nearness to e St. Louis market place, its accessibility to the uth and Southwest, its good access to Chicago, d of course, the most important of all, its own tural resources. Your particular location as it lates to the market places of St. Louis, Chicago, d the other metropolitan areas, should be studied you as individuals and communities. A deternation can be made as to the kind of industries at you can most likely secure, and the potential owth of the industry, as a result of your particu- location. Your location provides an opportunity for some industries and limitations to others.

In what Illinois community can I find all kinds of transportation, going in all directions (passenger and freight)? This question varies from industry to industry. Not all industries need all kinds of transportation. From the total industrial development potential standpoint, however, a community with all modes of transportation has the greatest advantage. It is important to have railroads, highways for trucking, airlines or airport facilities, and waterways. Of course, waterways give rise to a special kind of industry. Without the waterways a community or an area of the state can be eliminated immediately from consideration. In southern Illinois our *railroad* picture is very good. From the standpoint of *highways* we have always had good roads in our particular region. This situation is being improved still further. A number of area highways have been or are being rebuilt. With the completion of Inter-State route 57, now being constructed through our area, the market place in Chicago will be brought closer to southern Illinois. This will be a real asset to southern Illinois in terms of industrial growth and development. Many desirable industrial sites are going to be created alongside these new highways.

What cities in Illinois can provide me with a desired quantity of utilities at the most reasonable price? This, of course, involves power, water, natural gas, and sewage facilities. Southern Illinois stacks up pretty well on this score. In many cases, we have not taken full advantage of some of these resources. There are many good sites for additional lakes in southern Illinois, which if developed, could increase both the industrial potential as well as the tourist potential of our region. Rend Lake is a possibility; Carlyle and Shelbyville lakes are already a certainty. It is extremely important that restrictions not limit full development. One thousand new jobs could be created tomorrow in southern Illinois if a certain section of shore lines, next to one of the largest lakes in southern Illinois, were opened up for commercial development. This is typical of what could happen in southern Illinois if a *united effort* were to be put forth in this direction.

Can we be assured of an alert labor supply, having a good attitude, a favorable wage rate, with a reputation for productiveness and a history of good labor-management relations? It is certainly a known fact that in southern Illinois we have had a favorable labor supply and wage rate. All too often, I feel, a bad side of southern Illinois labor picture is presented for public consumption and is frequently blown up completely out of proportion. It is true that in southern Illinois there have been some incidents which would reflect a bad labor situation in any area. However, these situations are few. I feel that the discussions that are often originated by southern Illinois people concerning bad labor conditions do our reputation far more harm than the actual conditions themselves. I feel there is no

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need for an apologetic attitude toward southern Illinois. Labor also has a responsibility in helping to disprove these false assumptions.

I am sure that many southern Illinois workers want to help in the area of industrial development. They have this desire for two reasons: (1) civic pride; and (2) interest in helping to provide employment for those men and women who are unemployed and the children of today who will be seeking jobs tomorrow, and who, if employment is not found in southern Illinois, will necessarily go elsewhere to find work . . . Ninety percent of all industrial expansion and growth takes place from within existing industries. Bearing this in mind, we in southern Illinois, by full productiveness, can create a climate conducive for our own industries to expand. By having the kind of environmental reputation for which industries are looking, we will find them coming to our area knocking on *our* door rather than going to other sections of the nation.

What towns in Illinois have a reasonable tax rate for their industry? In other words, are the communities charging their existing industries only their fair share, or do the local governments have the philosophy that "lets stick it to the big boys because they have got it?" This is significant. It's significant on a local level as well as a state level. Let me caution you as citizens of Illinois. A year ago before our State Legislature, there were many groups making an effort to change our tax structure, and in particular they were interested in changing the tax structure as it relates to industries. Today, Illinois has a favorable tax climate for industries. If there is any great significant change in the amount of taxes that applies to Illinois industries, we will find ourselves losing our competitive position in our efforts to secure new industries, and will find Illinois industries who are today employing Illinois citizens in our state moving to neighboring states which offer a more favorable tax picture to industry.

Can we be assured of who our neighbors are going to be tomorrow? What towns in Illinois have city planning and zoning established through land-use studies? This matter seems to be of more and more interest to industries. It seems to reflect the willingness to plan for growth on the part of the community—the same kind of planning that we do when we use a blueprint to build a house. If such planning does not exist in a community it is certainly not listed as a plus mark when the industry is evaluating your city as a possible plant location.

Do the communities that I plan to visit have good housing, recreation, churches, educational, and other cultural facilities? The communities which are constantly improving these facilities are given primary consideration by industries, as they evaluate towns with the thought of locating a plant. It is extremely important that good housing, recreation, churches, educational facilities, and of course, other cultural facilities are available. Since all plants employ engineers, it is important to have plants located in the general area of an engineering school so that these engineers can go back to get some graduate work. Those of you who are especially interested in seeing industrial development take place in southern Illinois might want to bear this fact in mind when Southern Illinois University goes back to Springfield in an effort to secure an Engineering School for this section of the State of Illinois.

Where can I find a building or a site that will meet my requirements? More and more companies are listening to communities which offer to build a building to suit the companies needs. It is important that you set aside good industrial sites, to be used for that purpose. If this is done, and information is gathered together regarding how much it is going to cost you to run water and sewer facilities out to the site, the dimensions of the site pointing out the access of railroads and highways, you will find the industrial prospect very receptive to your efficiency. It would also be helpful to obtain an option on that site and to make certain that the land will be available at a reasonable price when the industry comes to call. Sometimes an area will lose an industry because the information is not available when your town is inspected. Bear this in mind, and gather your information and have it readily available.